

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Title: Semiconductor Device Encapsulators, Methods of Encapsulating Semiconductor
Devices and Methods of Forming Electronic Packages



PENDING CLAIMS AS OF DECEMBER 13, 2001

1. A method of encapsulating a semiconductor device, comprising:
providing at least one semiconductor device;
providing a dispensing apparatus having a plurality of dispensing orifices proximate the at least one semiconductor device;
dispensing a first liquid encapsulating material through at least one of the plurality of orifices and over the at least one semiconductor device and dispensing a second liquid encapsulating material through at least one other of the plurality of orifices, wherein the first liquid encapsulating material is different from the second liquid encapsulating material; and
wherein the plurality of dispensing orifices are capable of rotational movement while maintaining the proximity to the at least one semiconductor device.
2. The method of claim 1 wherein the first liquid encapsulating material is dispensed onto the at least one semiconductor device.

3. The method of claim 1 further comprising curing the dispensed first and second liquid encapsulating materials.
4. The method of claim 1 wherein the dispensing comprises flowing the first and second liquid encapsulating materials simultaneously through the plurality of orifices.
5. The method of claim 1 wherein the dispensing comprises moving the at least one of the orifices relative to the at least one semiconductor device while flowing the liquid encapsulating material through the at least one orifice.
6. The method of claim 5 wherein the moving comprises moving the at least one semiconductor device.
7. The method of claim 5 wherein the moving comprises moving the at least one orifice.
8. The method of claim 1 wherein the at least one semiconductor device is an integrated circuit chip.

9. A method of forming an electronic package, comprising:

- providing a circuit board comprising a circuit pattern;
- joining a semiconductor device to the circuit board in electrical connection with the circuit pattern;
- providing a dispensing apparatus having a plurality of dispensing orifices proximate the semiconductor device;
- dispensing liquid encapsulating material through the plurality of orifices and onto the semiconductor device, wherein at least one orifice dispenses liquid encapsulating material only onto the semiconductor device;
- curing the liquid encapsulating material; and

wherein the plurality of dispensing orifices are capable of rotational movement about a vertical pivot axis spaced from the dispensing orifices while maintaining the proximity to the semiconductor device.

10. The method of claim 9 wherein the dispensing comprises dispensing liquid through only one of the orifices and onto the semiconductor device, and dispensing liquid through a remainder of the plurality of orifices and onto the circuit board proximate the semiconductor device.

11. The method of claim 9 wherein the dispensing comprises dispensing liquid through the at least one of the orifices and onto the semiconductor device,

and dispensing liquid through a remainder of the plurality of orifices and onto the circuit board proximate the semiconductor device.

12. The method of claim 11 wherein the liquid dispensed through the remainder of orifices is the same as that dispensed through the at least one orifice.

13. The method of claim 11 wherein the liquid dispensed through the remainder of orifices is different than that dispensed through the at least one orifice.

14. The method of claim 11 wherein the dispensing through the remainder of orifices occurs simultaneously with the dispensing through the at least one orifice.

15. The method of claim 11 wherein the remainder of orifices comprises at least four orifices.

16. The method of claim 15 wherein the semiconductor device comprises a square-shaped lateral periphery.

17. The method of claim 9 wherein the semiconductor device is an integrated circuit chip.

18. A method of encapsulating at least two semiconductor devices, comprising:

providing at least two semiconductor devices over a substrate;

providing a dispensing apparatus having at least two dispensing orifices, a first of the at least two dispensing orifices being received proximate a first of the at least two semiconductor devices and a second of the at least two dispensing orifices being received proximate a second of the at least two semiconductor devices wherein the at least two dispensing orifices are capable of rotation about a vertical pivot axis spaced from the dispensing orifices; and

simultaneously dispensing a liquid encapsulating material through the at least two orifices and over the at least two semiconductor devices wherein the dispensing apparatus is continuously spaced from the semiconductor devices and substrate.

19. The method of claim 18 wherein the liquid encapsulating material is dispensed onto at least one of the at least two semiconductor devices.

20. The method of claim 18 wherein the liquid encapsulating material is dispensed onto both of the at least two semiconductor devices.

21. The method of claim 18 further comprising curing the dispensed liquid encapsulating material.

22. The method of claim 18 wherein the dispensing comprises moving the at least two orifices relative to the semiconductor devices while flowing the liquid encapsulating material through the at least two orifices.

23. The method of claim 18 wherein the semiconductor devices are integrated circuit chips.

24. A method of encapsulating a plurality of semiconductor devices, comprising:

providing a plurality of semiconductor devices over substrate;

providing a dispensing apparatus having an array of dispensing orifice sets, individual sets of the array being in correspondence with individual semiconductor devices of the plurality of semiconductor devices wherein at least one dispensing orifice is capable of rotation about a vertical pivot axis spaced from the at least one dispensing orifice; and

simultaneously dispensing liquid encapsulating material through orifices of different sets, and at least a portion of the liquid encapsulating material defining a discrete portion over the semiconductor device spaced from the substrate.

25. The method of claim 24 wherein the array of dispensing orifice sets is aligned with a first array of the plurality of semiconductor devices during the dispensing, the method further comprising moving the array dispensing orifice sets to alignment with a second array of semiconductor devices after the dispensing.

26. The method of claim 24 wherein the liquid encapsulating material dispensed through each of the different sets is the same.

27. The method of claim 24 further comprising curing the dispensed liquid encapsulating material.

28. The method of claim 24 wherein the dispensing comprises moving at least some of the orifices relative to the semiconductor devices during the dispensing.

29. The method of claim 24 wherein the semiconductor devices are integrated circuit chips.

30. The method of claim 24 wherein the individual sets comprise at least one interiorly located orifice and remaining orifices peripheral to the at least one interiorly located orifice, the dispensing from an individual set comprising:

dispensing a first liquid encapsulating material through the at least one interiorly located orifice and over a corresponding semiconductor device; and

dispensing a second liquid encapsulating material through the remaining orifices and over a portion of the substrate proximate the corresponding semiconductor device.

31. The method of claim 30 wherein the at least one interiorly located orifice is one orifice, and wherein the remaining orifices are four orifices.

32. The method of claim 30 wherein the first and second liquid encapsulating materials are the same.

33. The method of claim 30 wherein the dispensing through said at least one interiorly located orifice occurs simultaneously with the dispensing through said remaining orifices.

34. The method of claim 30 wherein the dispensing through said at least one interiorly located orifice occurs after the dispensing through said remaining orifices.

35. A method of encapsulating a plurality of semiconductor devices, comprising:

providing a plurality of semiconductor devices over substrate;

providing a dispensing apparatus having an array of spaced dispensing orifices, individuals of the array being in correspondence with individual semiconductor devices of the plurality of semiconductor devices wherein at least one dispensing orifice is capable of rotation about a vertical pivot axis spaced from the at least one dispensing orifice; and

simultaneously dispensing liquid encapsulating material through at least two of the spaced dispensing orifices and onto at least two of the individual semiconductor devices, at least a portion of the liquid encapsulating material defining a discrete portion over the semiconductor device spaced from the substrate.

36. A method of forming an electronic package, comprising:

providing a circuit board comprising a circuit pattern;

joining a plurality of semiconductor devices to the circuit board in electrical connection with the circuit pattern;

providing a dispensing apparatus having a plurality of dispensing orifices proximate the semiconductor devices wherein the plurality of dispensing orifices are capable of rotational movement about a vertical pivot axis spaced from the plurality of dispensing orifices;

simultaneously dispensing liquid encapsulating material through at least two of the plurality of orifices and over at least two of the semiconductor devices, at least a portion of the liquid encapsulating material defining a discrete portion over the semiconductor device spaced from the substrate; and
curing the liquid encapsulating material.

37. The method of claim 36 wherein the dispensing comprises dispensing the liquid onto the at least two semiconductor devices.

38. The method of claim 36 wherein the dispensing comprises:
dispensing a first liquid encapsulating material through the at least two orifices and over the at least two semiconductor devices; and
dispensing a second liquid encapsulating material through a remainder of the plurality of orifices and onto portions of the circuit board proximate the at least two semiconductor devices.

39. The method of claim 38 wherein the liquid dispensed through the remainder of orifices is the same as that dispensed through the at least two orifices.

40. The method of claim 38 wherein the dispensing through the remainder of orifices occurs simultaneously with the dispensing through the at least two orifices.

41. The method of claim 38 wherein the dispensing through the remainder of orifices occurs before the dispensing through the at least two orifices.

42. The method of claim 36 wherein the semiconductor device is an integrated circuit chip.

43. A method of forming an electronic package, comprising:
providing a circuit board comprising a circuit pattern;
joining a plurality of semiconductor devices to the circuit board in electrical connection with the circuit pattern, the semiconductor devices being arranged in a plurality of arrays;

providing a dispensing apparatus having a plurality of dispensing orifices proximate some of the semiconductor devices, the dispensing orifices being arranged in a single array of orifice sets which is aligned with a single of the semiconductor device arrays wherein at least one dispensing orifice is capable of rotational movement about a vertical pivot axis spaced from the at least one dispensing orifice;

simultaneously dispensing liquid encapsulating material through the array of orifice sets and over the single array of semiconductor devices wherein at least a portion of the liquid encapsulating material defines a discrete portion over the semiconductor device spaced from the substrate;

moving the orifice sets to align with another of the semiconductor device arrays; and

simultaneously dispensing liquid encapsulating material through the array of orifice sets and over the other array of semiconductor devices wherein at least a portion of the liquid encapsulating material defines a discrete portion over the semiconductor device spaced from the substrate.

44. The method of claim 43 wherein the individual orifice sets comprise five orifices.

45. The method of claim 43 wherein the individual orifice sets comprise at least two orifices, and wherein the dispensing from an individual orifice set comprises:

dispensing a first liquid encapsulating material through one of the at least two orifices and over an individual of the plurality of semiconductor devices; and

dispensing a second liquid encapsulating material through a second of the at least two orifices and over portions of the circuit board proximate the individual semiconductor device.

46. The method of claim 45 wherein the first and second liquid encapsulating materials are the same.

47. The method of claim 45 wherein the first and second liquid encapsulating materials are different.

48. The method of claim 45 wherein the first and second liquid encapsulating materials are dispensed simultaneously.

49. The method of claim 43 wherein the orifice sets comprise at least one interiorly located orifice and remaining peripherally located orifices, and wherein the dispensing from an individual orifice set comprises:

dispensing a first liquid encapsulating material through said at least one interiorly located orifice and onto an individual of the plurality of semiconductor devices; and

dispensing a second liquid encapsulating material through said remaining orifices and onto portions of the circuit board proximate the individual semiconductor device.

50. The method of claim 43 wherein the orifice sets comprise five orifices, and wherein the dispensing from an individual orifice set comprises:

dispensing a first liquid encapsulating material through one of the five

orifices and onto an individual of the plurality of semiconductor devices; and dispensing a second liquid encapsulating material through a remaining four of the five orifices and onto portions of the circuit board proximate the individual semiconductor device.

51. The method of claim 50 wherein the first and second liquid encapsulating materials are the same.

52. The method of claim 50 wherein the first and second liquid encapsulating materials are dispensed simultaneously.

53. A method of forming an electronic package, comprising:
providing a circuit board comprising a circuit pattern;
joining a plurality of semiconductor devices to the circuit board in electrical connection with the circuit pattern, the semiconductor devices being arranged in a plurality of arrays;

providing a dispensing apparatus having a plurality of spaced dispensing orifices proximate some of the semiconductor devices, the spaced dispensing orifices being arranged in a single array which is aligned with a single of the semiconductor device arrays wherein at least one dispensing orifice is capable of rotational movement about a vertical pivot axis spaced from the at least one dispensing orifice;

simultaneously dispensing liquid encapsulating material through the array of orifices and over the single array of semiconductor devices wherein at least a portion of the liquid encapsulating material defines a discrete portion over the circuit board spaced from the semiconductor devices;

moving the orifices to align with another of the semiconductor device arrays; and

simultaneously dispensing liquid encapsulating material through the array of orifices and over the other array of semiconductor devices wherein at least a portion of the liquid encapsulating material defines a discrete portion over the circuit board spaced from the semiconductor devices.